Locating Existing Water, Gas or Oil Wells

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Factsheet

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Replaces OMFARA Factsheet 04-063, Finding Water, Gas or Oil Wells On or Around Your Farm

Improperly constructed, maintained or abandoned wells present a safety risk to humans as well as a potential risk to pollute groundwater resources.

Over three million Ontarians depend on more than 750,000 domestic and municipal wells for water. There are many old wells throughout Ontario that were installed prior to the introduction of minimum construction, maintenance or abandonment standards. The risk of groundwater contamination from these wells is significant (Figure 1).

Oil was originally discovered in 1858 in Lambton County and led to the rapid development of thousands of oil wells throughout that area (Figure 2). Development of both oil and gas continued south and along an extensive zone north of Lake Erie. It is estimated that more than 50,000 oil and gas wells have been drilled with records available for only 20,000. Gas and oil wells can pose the same risk and potential for groundwater contamination as water wells.

Figure 1. Unused water well.

Figure 2. Old oil well with wooden storage tank.

Ontario's *Nutrient Management Act, 2002, (NMA)* Ontario *Regulation 267/03* and associated protocols were developed to help reduce agriculture's impact on both surface and groundwater resources. One key strategy of this regulation is to address risks related to nutrient management activities around wells. Applying nutrients (Table 1) and siting new storage facilities require minimum setbacks from various types of wells. These setbacks apply to any existing well — new or old, used or unused. When preparing a Nutrient Management Plan (NMP) or Nutrient Management Strategy (NMS) every effort must be made to identify all wells (water, oil and gas) regardless of age, type and whether in use or not.

Ministry of Agriculture, Food and Rural Affairs

Ontario

Table 1. Land Application Setback Distances from Wells

1.	No application of nutrients to land closer than 100 m to a municipal well (including commercial fertilizer).
2.	No application of prescribed materials to land closer than 15 m to a drilled well that has a depth of 15 m or more and a watertight casing to a minimum depth of 6 m below ground level.
3.	No application of Agricultural Source Material or (CM1 [a] & CP1 [b] Non Agricultural Source Material), to land closer than 30 m to a well other than a well as described in 1 & 2 above.
4.	No application of Non Agricultural Source Material that is CM2 [c] or CP2 [d] i.e. biosolids to land closer than 90 m to a well other than a well as described in #1 & 2 above.
5.	No application of commercial fertilizer or compost (Meeting MOE standards) to land closer than 3 m to water well (not a municipal well).

The Ontario Regulation 267/03 as amended, defines a well as: any gas well, oil well, unused well, test well, and water well.

[a] - Content of Metals Category 1, Definition found in O. Reg 267/03, s. 1

[b] - Content of Pathogens Category 1, Definition found in O. Reg 267/03, s. 1

[c] - Content of Metals Category 2, Definition found in O. Reg 267/03, s. 1

[d] - Content of Pathogens Category 2, Definition found in O. Reg 267/03, s. 1

WHO SHOULD BE CONCERNED

Landowners applying nutrients of all types, whether manure, biosolids, commercial fertilizer, etc., need to know about all of the different wells on their property. Every effort must be made to locate all wells including oil, gas, private and municipal water wells, farm wells for irrigation and livestock watering, commercial, industrial, dewatering and monitoring wells, as well as test bore holes. This includes both active and unused wells. Due to the potential risk of contaminating an active aquifer this must be done prior to spreading any type of material including nutrients, herbicides and pesticides.

WHY YOU SHOULD BE CONCERNED

Wells, especially poorly maintained and improperly plugged wells, are potentially some of the most effective pathways for contaminants to enter the groundwater. If not constructed properly, maintained or plugged, wells can provide a direct conduit for contaminants to either enter the groundwater or to rise from a well to the land surface. Unlike soil, where contaminants move extremely slowly from surface to groundwater, wells can allow surface contaminants to enter and immediately affect groundwater. Foreign materials such as surface water can enter a well because of improperly sealed openings, missing or loose well caps, corroded steel casings or poorly sealed casings.

GOOD REPAIR OR PROPERLY PLUGGED

Water well construction and abandonment is currently regulated under the *Ontario Water Resources Act. R.R.O. 1990,* Regulation 128 Wells. The regulation specifies minimum standards that ensure wells are constructed according to minimum construction standards. The well regulation also clearly places the responsibility for maintenance and abandonment on well owners. It also requires that wells no longer in use be plugged and sealed using regulated procedures.

For more information on water well construction, maintenance and plugging see References at the end of this Factsheet or Best Management Practices: *Water Wells* (BMP 12), published by the Ministry of the Environment and OMAFRA.

Similarly, under the *Oil, Gas and Salt Resources Act, 1997,* tough standards ensure that oil and gas wells are developed and decommissioned under strict guidelines. Many earlier gas and oil wells had inferior or improper linings, with the earliest wells being lined with wood. To err on the side of caution, landowners must assume that any unused wells found on their property have not been properly sealed or permanently plugged.

LOCATING OLD WELLS — WHAT TO LOOK FOR

Dug wells were commonly constructed prior to the development of boring and drilling methods. These wells were frequently hand dug typically less than 9 m deep and 61–120 cm in diameter and cribbed or lined with stacked fieldstone, bricks or similar material. Later, backhoes did the excavating. These wells target shallow groundwater supplies. Because of the large width, shallow depth and unsealed, generally non-watertight casing, these wells can pose a considerably higher risk of contamination than drilled wells.

Bored wells are augured and target relatively shallow groundwater, generally less than 15 m but can be up to 30 m in depth. Well casings are usually cement tile or corrugated galvanized pipe. Older wells were commonly lined with clay tiles. The susceptibility to contamination is similar to that of dug wells because of their similar design characteristics and poorly sealed casing joints.

Drilled wells can be constructed deep below ground into any subsurface material, including bedrock. Wells have been drilled to a depth of 185 m or

more, but are commonly 15–60 m in depth with a casing diameter of 10–20 cm. Due to the better construction equipment and usually greater depths, these wells are less likely to become contaminated. Casings are usually steel with welded or threaded joints to prevent contaminated surface waters or shallow groundwater from entering through the side of the well casing. Other casing material includes PVC, brass, copper, stainless steel and fibreglass. Oil and gas wells are also constructed with steel casings.

Older oil and gas wells generally have largely uncemented steel liners whereas newer wells usually have steel casings that are cemented full length. Very old oil wells may have wooden liners.

Jetted, well points and driven wells are usually small diameter wells either driven, or jetted using high-pressure water, into the ground. Common diameters of these types of wells are 25–50 mm. These wells source shallow groundwater aquifers in sand or gravel that are more easily contaminated.

KEY AREAS TO LOOK FOR WELLS

Start by searching documents that may identify the location of wells. Look for:

- water well records (Ministry of the Environment)
- oil and gas well records (Ontario Oil, Gas & Salt Resources Library, London, Ontario)
- building permits, old land deeds, property surveys and land transfer documents (municipal and township offices)
- old fire insurance plans

And if there was a house or a livestock barn, there is a good chance a water well was used.

Consider aerial photography as a source of information on the area's past land use and changes over time to identify potential locations of unused wells. They can help identify old barns, homes, windmills and other important structures that may be associated with an old well where there may no longer be any visible evidence remaining of past development. Stereo aerial photography provides a three dimensional image so small buildings, windmills or similar structures can be easily identified from surrounding textures that may not be available with regular aerial photography. Long time neighbours or drillers may also help in identifying past farmsteads where unused wells could be found (Figure 3). Occasionally dug wells were located in low-lying areas, i.e. edge of wetland, away from the farmstead.

Figure 3. Abandoned farmstead.

HOW TO SYSTEMATICALLY SEARCH FOR POTENTIAL WELL SITES

After reviewing physical records or maps, it is time to conduct a systematic land search for potential well sites.

- Focus on sites where water is commonly used: residences, dwellings, barns, livestock feeding sites and fields with irrigation or past irrigation permits. These areas will include old abandoned farmsteads.
- Draw a sketch of the property, identifying potential sites.
- Carefully walk the entire property, looking for any areas that may be an old farmstead site. Watch carefully for unplugged wells.
- Uncultivated areas (grassy and treed areas) within actively cropped fields may offer some clues, especially for locating old oil and gas wells.
- Look for any metal or wooden debris indicating a well may be near.
- Look for pipe or casing material or covers that may conceal a well. Again, take care in moving any material that may be covering an old well as the ground nearby or the old well top may be unstable and collapse.

Also look for:

- abandoned houses, windmill sites, outbuildings, pump houses, barns

- old foundations (wells were frequently located in basement of houses and underneath stairwells)
- collapsed buildings and piles of wood or other debris
- silos, feeding pens and watering troughs

Next, use the map of potential areas where wells could be found and begin a more thorough investigation. Wells are likely located close to the intended use (i.e. watering livestock, domestic use). The site investigation should now focus on finding the actual well. At this point look for materials that may have been used to construct and support the well:

- old hand pumps, drill bits or other material used to drill the well
- piles of rocks, clay tiles, steel casings
- electrical switch boxes and pump motors to run pumps
- rings of concrete, bricks, wood and cement pits
- buried piping that has surfaced may have connected to a well at one point in time.

Pipes sticking out of the ground are extremely suspect (Figure 4). Abnormal depressions in the ground, especially those supporting permanent open seepage and aquatic vegetation, could indicate old collapsed dug or bored wells or well pits, all of which can have quite large well diameters. Further supportive evidence would include the discovery of cribbing or support material which lined the well i.e. cobble, field stone, wood, brick etc.

Figure 4. Surfaced well pipes.

FINDING OIL AND GAS WELLS

Use a similar systematic approach to identify unused oil and gas wells. Only landowners in **Lambton, Kent, Essex, Elgin, Oxford, Norfolk, Haldimand, Brant, Welland** and **Niagara** need to find oil and gas wells on their property. To a lesser extent **Huron, Middlesex, Perth, Wentworth, Halton, Wellington, Grey and Bruce** counties also had some development of varying degrees.

Oil and gas fields are typically developed as a cluster of wells and are joined by infrastructure to efficiently remove and store product from the deposit on the same site. Signs of past producing sites and unused oil and gas wells include:

- pipes joining wells to holding tanks, oil spills (early oil production)
- storage tanks sunken and above ground, wooden and metal construction
- pumping systems i.e. jack pumps
- well access trails or roads, cement or stone drilling pads
- old drilling equipment, bits, cable, steel rods and metal casings (Figure 5)
- electrical boxes, utility poles and remnants of electrical, motors or engines required to power pumps

Figure 5. Unused oil or gas well and remnants.

These wells could be located anywhere on the property. Long established neighbours or local community members are invaluable sources of information, as well as historic aerial photos. Look for changes in vegetation development or sites (Figure 6) and access trails disturbed by previous oil and gas activity. Soils at these locations may be compacted so vegetation is stunted and sparse. Many old oil pumps and storage tanks commonly leak oil on site. Sites absent of vegetation or with tar-like deposits are good indicators. Old oil and gas wells may also leak methane, or salty or sulphurous waters that kill vegetation.

Figure 6. Old oil well site, note the lack of vegetation.

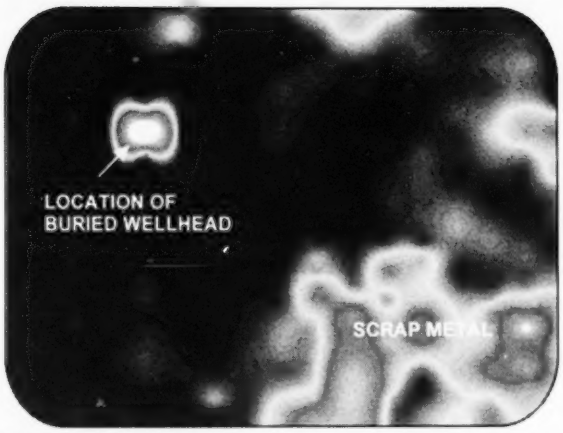

Figure 7. EM61 Well survey image. (Source: Conestoga-Rovers & Associates)

As a best management practice identify on a sketch or map all suspect sites, blast holes, cisterns, and exploration boreholes for mineral, geothermal, geological, or geophysical purposes. Mark all confirmed or highly suspect well locations on maps.

Other Resources to Identify the Locations of Old Unused Wells

One difficulty in locating some wells is that over time:

- they may have back-filled (improperly plugged)
- the casing may have been cut off below the ground surface or
- the wellhead may be buried, leaving no visible evidence at the surface

In these situations wells can often be located efficiently using non-invasive geophysical survey methods. Geologists commonly use these surveys to locate metallic minerals and oil and gas deposits buried beneath the earth's surface. Geophysical surveys allow interpretation of various formations, objects and processes in the ground without costly excavation. Three surveys considered practical for locating well-type structures are: electromagnetic, magnetic and ground penetrating radar.

Steel casings can be detected using an electromagnetic (EM) instrument (buried metal detector) or a magnetometer (which measures the strength of the earth's naturally occurring magnetic field). Magnetic surveys are more susceptible to interference from metal objects such as vehicles and metal clad buildings than EM surveys. To find buried wells with little metal, a Ground Penetrating Radar (GPR) survey may be used. Due to cost considerations, a GPR survey is most effective when focused on a few key areas of a site.

REPORTING PREVIOUSLY UNKNOWN WELL LOCATIONS

Report any well discovered that has no previous record either within the MOE or the Ministry of Natural Resources. This will provide valuable information to future generations of land users and developers. There may be multiple old wells on a single property; do not stop looking after the first one is located!

For water well plugging requirements, refer to Best Management Practices *Water Wells,* BMP 12 or contact the MOE. Any person or business hired to plug and seal any water well must be licensed by the MOE and report each well plugging to the ministry. Contact the MNR for oil and gas wells licensing and plugging standards.

WELL QUICK REFERENCE CHECK OFF

High Potential for a Well?

- ☐ Farm properties that include multiple farmsteads, abandoned land or structures and uncultivated sites.
- ☐ Farm located in a former or current oil/gas producing area.
- ☐ Areas of different or stunted vegetation, compacted trails/sites, oil residue, abandoned drilling pads.

Unused Well Investigation

- ☐ Searched for records of oil, gas and water well locations (MNR & MOE).
- ☐ Searched for old irrigation permits, building permits, site surveys and plans.
- ☐ Thorough ground investigation of abandoned fields, old farmsteads, former livestock feeding sites and fence lines.
- ☐ Checked around debris piles, old foundations, and partially buried pipes, stone, brick, wood, clay tiles and well casings.
- ☐ Farm infrastructure examined including:
  - ☐ windmill sites
  - ☐ holding tanks
  - ☐ farm structures
  - ☐ out buildings
  - ☐ outdoor electrical boxes
  - ☐ abandoned utility poles
  - ☐ abandoned well pumps, hand pumps and motors
- ☐ Have other aids including aerial photos or geophysical surveys been utilized?
- ☐ Deep pits or unusual depressions with seepage and aquatic vegetation, stunted, dead or no vegetation areas.

REFERENCES AND SOURCES

Legislation

Nutrient Management Act, 2002, Ontario Regulation 267/03 as amended

Nutrient Management Protocols

Ontario Water Resources Act, R.R.O. 1990, Regulation 128 Wells (under the OWRA)

Oil, Gas and Salt Resources Act 1997

Web sites

Ontario Ministry of Agriculture and Food
www.omafra.gov.on.ca

Ontario Ministry of the Environment
www.ene.gov.on.ca

Petroleum Resources Centre, Ontario Ministry of Natural Resources
www.mnr.gov.on.ca

Ontario Petroleum Institute
www.ontpet.com

Oil, Gas and Salt Resources Library
www.ogsrlibrary.com

Agriculture and Agri-Food Canada
www.agr.gc.ca

National Air Photo Library
www.airphotos.nrcan.gc.ca

Agriculture, Food and Rural Development
www.agric.gov.ab.ca

Publications

Well Aware: A Guide for Well Owners
www.wellaware.ca

OMAFRA Best Management Practices:
Water Wells. BMP 12
Water Management. BMP 7
Water Wells & Ground Water Supplies in Ontario, Ontario Ministry of the Environment.

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DO YOU KNOW ABOUT ONTARIO'S NUTRIENT MANAGEMENT ACT?

The provincial *Nutrient Management Act* (*NMA*) and the Regulation 267/03 regulates the storage, handling and application of nutrients that could be applied to agricultural cropland. The objective is to protect Ontario's surface and groundwater resources.

Please consult the regulation and protocols for the specific legal details. This Factsheet is not meant to provide legal advice. Consult your lawyer if you have questions about your legal obligations.

For more information on the *NMA* call the Nutrient Management Information Line at 1-866-242-4460, e-mail nman.omafra@ontario.ca or visit www.ontario.ca/omafra

Factsheets ar ontinually being updated so please ensure that you have the most recent version.

Agricultural Information Contact Centre:
1-877-424-1300
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Northern Ontario Regional Office:
1-800-461-6132

www.ontario.ca/omafra

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